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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/593,832	11/21/2006	Tadatoshi Kurozumi	Q80768	5492
23373 7590 04/27/2010 SUGHRUE MION, PLLC 2100 PENNSYLVANIA AVENUE, N.W. SUITE 800 WASHINGTON, DC 20037				
EXAMINER NGUYEN, COLETTE B				
ART UNIT 1793		PAPER NUMBER		
NOTIFICATION DATE 04/27/2010		DELIVERY MODE ELECTRONIC		

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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### Office Action Summary

**Application No.**

10/593,832

**Applicant(s)**

KUROSUMI ET AL.

**Examiner**

COLETTE NGUYEN

**Art Unit**

1793

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 05 April 2010.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-33 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-33 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO/SB/CD)  
Paper No(s)/Mail Date \_\_\_\_\_
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: \_\_\_\_\_

**DETAILED ACTION**

***Status of the application***

*RCE filed on 04/05/10*

*Claim 1 amended, claim 33 New.*

*Claims 1 to 33 are presented for examination*

***Continued Examination Under 37 CFR 1.114***

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 04/05/10 has been entered.

***Claim Rejections - 35 USC § 103***

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. **Claim1-33** are rejected under 35 U.S.C. 103(a) as being unpatentable over Ohmori et al. (US2002/0150532) in view of Tanaka et al (US6544493) with further in view of Miyoshi (US6485701)
3. **Regarding claim 1 and 33.** Ohmori teaches a perovskite type composite oxide containing titanium oxide with formula  $M(TiO_3)$  wherein M is at least one selected from Ca, Sr, Ba (alkaline earth metal) and Pb with the specific surface area of the particles in a range of 10 to about 200  $m^2/g$  with excellent dispersion properties and sufficient transparency when formed into a thin film that can applied to a memory and a photocatalyst. (Abstract, para 15). The production methods are not limited as long as the titanium oxide particles have brookite crystalline *at 10 to about 100% by wt.* (para 21) using titanium tetrachloride as precursor. He further teaches that the brookite crystalline are formed by subjecting the anatase titanium oxide particles to thermal treatment in a vapor phase (para 22). As brookite crystalline is formed *in situ* from anatase crystalline under the thermal treatment in vapor phase condition, it would be obvious that the content of *anatase should be between 10-100 %* by wt at the minimum despite that he does not specify that the content of anatase titanium oxide is 20 to 100 % by wt. The range is overlapped therefore it is obvious. (See MPEP. 2144). Tanaka et al (US6544493) on the other hand teaches titanium oxide particles process, also from titanium tetrachloride precursor, using vapor phase process in alkaline solution (Col 4, line 30) wherein the particles have ultra-fine particulates with specific area of 10  $m^2/g$  to about 200 $m^2/g$  with excellent dispersibility and with little aggregation (Col 3, line 26-35). He further points out (in col 1, line 64 to col2, line 8) that the titanium oxide is generally

produced either by hydrolyzing or by vapor phase process the titanium tetrachloride precursor and then reacted in the gas state with an oxidizing gas such as oxygen or steam at high temperature. However the liquid phase process (hydrolysis) undergoes heavy aggregation. Miyoshi (US6,485,701) further discloses a process to make small particle perovskite structure of oxide (barium titanate) with anatase crystalline exhibited ferroelectricity with the metallic oxide specific area of  $10 \text{ m}^2/\text{g}$  or more with heat treatment at a partial pressure of oxygen. The subject matter as a whole would have been obvious for one of ordinary skill in the art at the time of the invention to replace the hydrolysis process (causing heavy aggregation) in alkaline solution of Ohmori (para 30) with the teaching of Tanaka of vapor phase as both teach method of making titanium oxide compound using titanium tetrachloride as a precursor to produce titanium-containing mixed oxide particles having a small particle size with specific surface of  $10\text{-}200 \text{ m}^2/\text{g}$  with excellent dispersibility for a perovskite type product. As for the higher percent of anatase titanium oxide claim, as said above Ohmori specifies clearly to obtain ultrafine particles, the titanium oxide has to have 10 to 100% by wt of brookite crystalline which is formed in situ by vapor phase from anatase crystalline therefore the content of anatase crystalline would be from 10 to 100 % by wt. and Miyoshi reconfirms by disclosing that small oxide with anatase crystalline having perovskite structure would exhibit ferroelectricity. Therefore it would have been obvious for one in the art at the time of the invention to claim a high percentage of anatase of 20-100% by wt, in particular as high as 80% or more when otherwise all the key elements have been known.

4. Regarding claim 2. Ohmori in view of Tanaka and Miyoshi disclose a method for producing a titanium-containing perovskite compound as claimed in claim 1, wherein primary particles of the titanium-containing perovskite compound have a diameter (D1) that is 50 to 200% the size of primary particles of the titanium oxide serving as a starting material, the size (D1) being determined by converting the specific surface area (S) of the particles obtained by the BET method to the total surface area of spheres in accordance with the following equation (i):

$$D1 = 6/pS \text{ (i)}$$

wherein  $p$  represents a density of the particles and  $S$  represents a BET specific surface area. Ohmori (para 0017-0019).

5. Regarding claim 3. Both Ohmori and Tanaka teach a BET specific surface area of 3-200 m<sup>2</sup>/g. Tanaka (col 3, line 26-35) and Ohmori (para 0015).

6. Regarding claim 4. Tanaka discloses the method for producing a titanium-containing perovskite compound as claimed in claim 1, using the titanium oxide produced by oxidizing titanium tetrachloride at high temperature by using of an oxidizing gas at 500C or more. Tanaka (col4 line 6).

7. Regarding claim 5. Ohmori in view of Tanaka and Miyoshi disclose a method for producing a titanium-containing perovskite compound as claimed in claim 4, specifically, Tanaka teaches the titanium oxide produced by a vapor-phase method by respectively introducing a titanium tetrachloride-containing gas and an oxidizing gas which are heated in advance to 500°C or higher into a reaction tube at a flow rate of 10 m/sec or more. Tanaka (col4, line 1-23 ).

8. Regarding claim 6. Ohmori in view of Tanaka disclose a method for producing a titanium-containing perovskite compound as claimed in claim 5, using the titanium oxide produced by retaining the titanium tetrachloride-containing gas and the oxidizing gas in the reaction tube for one second or shorter under a high-temperature condition higher than 600°C. Tanaka (col4 line 1-23).
9. Regarding claim 7. Tanaka discloses an average gas flow rate in the reaction tube of 10 m/sec or more which overlaps with the claim of 5 m/sec or more. Tanaka (col 4, line 10).
10. Regarding claim 8. Tanaka discloses a vapor-phase method by introducing the preheated titanium tetrachloride-containing gas and oxidizing gas into the reaction tube in such a manner that turbulence is generated in the reaction tube. Tanaka (col6, line41).
11. Regarding claim 9. Ohmori in view of Tanaka and Miyoshi disclose a method for producing a titanium-containing perovskite compound as claimed in claim 8, using the titanium oxide produced by introducing the titanium tetrachloride-containing gas and the oxidizing gas into the reaction tube through a coaxial parallel flow nozzle and the inner tube of the coaxial parallel flow nozzle has an inside diameter of 50 nm or less (col6, line 48-60).
12. Regarding claim 10. Ohmori in view of Tanaka and Miyoshi disclose a method for producing a titanium-containing perovskite compound as claimed in claim 4-wherein the titanium-tetrachloride-containing gas has a titanium tetrachloride content of 10 to 100%. Tanaka (para 0018).

13. Regarding claim 11. Ohmori in view of Tanaka disclose a method for producing a titanium-containing perovskite compound as claimed in claim 5, wherein each of the titanium tetrachloride-containing gas and the oxidizing gas is heated in advance at 800°C or higher. Tanaka (para 0019).

14. Regarding claim 12. The method for producing a titanium-containing perovskite compound as claimed in claim 1, wherein the titanium oxide produced by a vapor-phase method has a mean particle diameter at a 90% cumulative weight on the particle size distribution curve (D90) of 2.2 µm or less. Tanaka (col 5, line 16).

15. Regarding claim 13. Ohmori in view of Tanaka and Miyoshi disclose a method for producing a titanium-containing perovskite compound as claimed in claim 1, wherein the titanium oxide produced through a vapor-phase method has a distribution constant  $n$ , as calculated from the following Rosin-Rammler equation (2), of 1.7 or more:

$$R=100 \exp(-bD^n) \quad (2)$$

Wherein  $D$  is a particle diameter;  $R$  is the percentage of the number of particles larger than  $D$  (particle diameter) with respect to the total number of particles;  $n$  is a distribution constant; and  $b$  is a reciprocal of particle characteristic constant. Tanaka (col4 line 50- col 5, line16).\

16. Regarding claim 14. Ohmori in view of Tanaka disclose a method for producing a titanium-containing perovskite compound as claimed in claim 1, wherein the titanium oxide produced by a vapor-phase method contains anatase-crystal-form titanium oxide. Tanaka (para 0035, "The fine particulates of titanium oxide of the present invention may



*be contained as a pigment or a particle component using the photocatalytic effect in various compositions".* Only anatase crystal form of titanium oxide exhibits this characteristic, not the brookite type.

17. Regarding claims 15 and 16. Ohmori in view of Tanaka and Miyoshi disclose a method for producing a titanium-containing perovskite compound as claimed in claim 1 using an alkaline solution in which a basic compound exists and wherein the basic compound is selected from ammonium, organic amine and hydroxide of ammonium salt. Ohmori (para 27, 28). Despite that "organic amine" is not specified, it would have been obvious for one of ordinary skill in the art to select organic amine as it is an organic alkali compound such as ammonium tetramethyl hydroxide as taught by Ohmori.

18. Regarding claim 17. This is a product by process claim. See discussion of claim 1

19. Regarding claims 18,19,22,23,24,25,26,27,28,29,30,31,,32. Ohmori in view of Tanaka and Miyoshi teach all the instant claims by disclosing all the functional applications including and not limited to dielectric materials, piezoelectric, memory media and photocatalysts such as thin-film, ceramic, electronic devices. Ohmori (claims 8-13)

20. Regarding claims 20 and 21. Ohmori in view of Tanaka and Miyoshi disclose a paste and slurry containing titanium-perovskite compound as claimed in claim 18. (See the examples in both references)

***Response to Arguments***

16. Applicant's arguments filed 04/05/10 have been fully considered but they are not persuasive for the following reasons:

17. Ohmori 's invention exhibits paraelectricity and is an hydrolysis in an acid solution. First and foremost, paraelectricity or ferroelectricity are not in any claim.

Despite that the preferred method is hydrolysis in acid, but Ohmori clearly discloses that the reaction conditions are not limited, and vapor phase was mentioned and it is preferably to carry out the reaction in an alkaline solution (para 0030). And Tanaka points out the option of replacing the hydrolysis process with vapor process to eliminate aggregation. Therefore the invention would be obvious for one of ordinary skill in the art at the time of the invention to replace the hydrolysis process of Ohmori with Tanaka 's vapor process to improve the quality of the particles.

18. Tanaka do not suggest that the titanium dioxide can be used in a method to produce a titanium –containing perovskite. Tanaka discloses a vapor phase process to make ultra fine titanium oxide having specific surface of 10- 200 m<sup>2</sup>/g using titanium tetrachloride as precursor, the same condition as Ohmori disclose to make a perovskite titanium oxide particles, especially when high percentage of brookite is required 10-100% by wt which are formed in situ from anatase crystalline therefore it would have been obvious for one of ordinary skill in the art to replace Ohmori's hydrolysis process with the vapor phase process of Tanaka with certain expectation of success as the particle sizes are similar and the precursor is the same and the vapor phase process would enhance the formation of brookite crystalline from anatase as disclosed

***Conclusion***

19. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. EP1148030, EP1231186.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to COLETTE NGUYEN whose telephone number is (571)270-5831. The examiner can normally be reached on Monday-Thursday, 10:00-4:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Curt Mayes can be reached on (571)-272-1234. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/COLETTE NGUYEN/  
Examiner, Art Unit 1793

/David M Brunsman/  
Primary Examiner, Art Unit 1793